U.S. NONPROVISIONAL PATENT APPLICATION

METHOD AND APPARATUS FOR CUTTING SHEET METAL

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METHOD AND APPARATUS FOR CUTTING SHEET METAL

This invention is in the field of metal working and in particular cutting sheet metal.

BACKGROUND

Sheet metal is generally available either in plates or coils of various sizes. The user generally cuts the pieces he requires from the plate or coil.

Computerized cutting tables are presently available wherein a plate of sheet metal is laid on the table, and cuts through the plate are made in an X - Y grid to obtain the required pieces. A cutting head, using oxygen/acetylene, laser, water, plasma or the like, is mounted on a carriage above the table and controlled by the computer to move in both the X and Y directions in a coordinated fashion to keep the speed of the cutting head relative to the plate substantially constant. The shape of the desired piece, or of many different pieces, is programmed into the computer

and the X and Y movements of the cutting head result in the programmed pieces being cut from the plate.

The cutting head must be movable both across the width of the plate and along the length of the plate. These tables are therefore quite complex and expensive, especially for use on larger plates. It is generally desirable to use a larger plate as the computer can be programmed to cut the required pieces with less waste. There is almost always some waste at the end of the plate, as the plates most commonly come in standard sizes, and so the user must arrange the cuts to make the most from the given plate. The cutting tables also only accommodate certain sized plates.

The surface of the table must generally be cleaned of cutting debris before a new plate can be positioned. This cleaning and positioning takes time.

SUMMARY OF THE INVENTION

It is the object of the present invention to provide an apparatus for cutting sheet metal pieces from a sheet metal

coil more economically and with less waste than present apparatuses for cutting such pieces from a sheet metal plate.

It is a further object of the invention to provide such an apparatus wherein the cutting head moves only along a line above the sheet metal, and the sheet metal is moved perpendicular to that line to provide for cutting in an X - Y plane such that pieces may be cut from the sheet metal.

The invention provides, in one aspect, an apparatus for cutting sheet metal pieces from a sheet metal coil having a coil axis. The apparatus comprises a coil support adapted to support the sheet metal coil such that same may rotate about the coil axis to unroll an end portion of the sheet metal coil and a sheet support adapted to support the end portion for cutting. A cutting head is mounted above the sheet support and end portion and is operative to cut through the end portion. A cutting head drive is operative to move the cutting head back and forth along a first path parallel to the coil axis and a sheet metal drive is operative to move the end portion forward and rearward along a second path perpendicular to the coil axis. A

computer is operative to control and coordinate the sheet metal drive and the cutting head drive such that the pieces are cut from the end portion.

A coil drive may be provided and controlled by the computer so that a slack portion of sheet metal is provided between the sheet metal coil and the sheet metal drive. The sheet metal drive then does not have to rotate the sheet metal coil but only moves a portion of sheet metal forwards and rearwards. The inertia of the sheet metal coil can be quite substantial where the coil is large, leading to slippage and jerky motion of the sheet metal where the inertia must be overcome by the sheet metal drive.

The invention provides, in a second aspect, a method of cutting sheet metal pieces from a sheet metal coil, the sheet metal coil having a coil axis. The method comprises positioning an end portion from the sheet metal coil to rest on a sheet support; moving a cutting head back and forth above the end portion and the sheet support along a first path parallel to the coil axis to cut the end portion; moving the end portion forward and rearward along a second path perpendicular to the coil axis; and

coordinating the movements of the cutting head and the sheet metal along the first and second paths such that the pieces are cut from the sheet metal.

DESCRIPTION OF THE DRAWINGS:

While the invention is claimed in the concluding portions hereof, preferred embodiments are provided in the accompanying detailed description which may be best understood in conjunction with the accompanying diagrams where like parts in each of the several diagrams are labeled with like numbers, and where:

Fig. 1 is a top view of an embodiment of the invention showing only the essential elements of the apparatus;

Fig. 2 is an end view of the embodiment of Fig. 1;

Fig. 3 is a side view of the embodiment of Fig. 1;

Fig. 4 is a schematic top view of guide rollers as they could be added to the embodiment of Fig. 1;

Fig. 5 is a schematic side view showing alternate measuring wheels to determine the position of the sheet metal on the Y-axis.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS:

Figs. 1, 2 and 3 illustrate an apparatus 1 for cutting sheet metal pieces from a sheet metal coil 2 having a coil axis 2A. The apparatus 1 comprises a coil support comprising coil rollers 3 and 4 which support the sheet metal coil 2 such that same may rotate about the coil axis 2A to unroll an end portion 2E.

A sheet support, as illustrated comprising a pair of support rollers 5, 6, and table 7, supports the end portion 2E for cutting. Further rollers, or other supports may be substituted for the table 7, or for short pieces the table might be removed. The size and shape of the pieces being cut will dictate what support is needed for the end portion 2E.

A cutting head 8 is mounted above the support rollers 5, 6 and end portion 2E resting thereon, and is operative to cut through the end portion 2E. A cutting head drive 9 is operative to move the cutting head 8 back and forth along a first path X parallel to the coil axis 2A. The cutting head 8 can be oxygen/acetylene, plasma, pressurized water, laser or any such conventional cutting head.

The support rollers 5, 6 define an open space 10 beneath the end portion 2E under the first path X such that cutting debris can fall through the open space 10. The cutting head 8 moves only over this open space 10 as well, avoiding the problem in conventional tables where the cutting head passes over various support members under the plate, causing damage to the members and requiring repair or replacement after some usage.

A sheet metal drive 11 comprises a pair of upper and lower drive rollers 12, 13 driven by sheet drive motor 14. The end portion 2E passes between the drive rollers 12, 13. The sheet metal drive 11 moves the end portion 2E forward and rearward along a second path Y perpendicular to the coil axis 2A. The illustrated drive rollers 12, 13 extend

right across the end portion 2E, however same could engage only a portion of the width of the end portion 2E. Other sheet metal driving mechanisms could be used as well.

A computer 15 is operative to control and coordinate the cutting head drive 9 and the sheet metal drive 11 such that the pieces are cut from the end portion 2E. The computer 15 performs essentially the same functions as that of a conventional computerized cutting table. Instead of moving the cutting head in both the first and second paths X, Y as in the conventional apparatus, the computer moves the cutting head back and forth along the first path X and moves the end portion 2E of sheet metal back and forth along the second path Y. As in the conventional apparatus, various shapes of pieces required may be programmed into the computer 15, which will then coordinate movement of the cutting head 8 relative to the end portion 2E in the X and Y paths to cut the pieces.

The computer can take information respecting the position of the end portion along the Y path from the drive rollers 12, 13 or alternatively the apparatus 1 can further comprise an independent measuring device operable to

transmit information respecting the position of the end portion 2E along the second path Y to the computer 15 so that the computer can use this information to control the sheet metal drive 11. In this manner, any slippage of the drive rollers 12, 13 will not affect the accuracy of the apparatus. As illustrated in Fig. 5 the measuring device can comprise a wheel 16 bearing against a surface of the end portion 2E. The wheel 16 comprises a resilient circumferential surface, as in 16a, a plurality of teeth on the surface thereof as in 16b, or other suitable surface to ensure there is no slippage between the wheel 16 and end portion 2E. Other measuring devices are known as well which would serve the purpose.

The illustrated apparatus 1 further comprises a coil drive motor 20 connected to rotate coil roller 3 and thereby rotationally drive the sheet metal coil 2 about the coil axis 2A. The computer 15 is operative to control the coil drive motor 20 and rotate the sheet metal coil 2 in a sheet advancing direction SA, wherein the sheet metal unrolls off the sheet metal roll 2, and in a sheet retracting direction SR wherein sheet metal rolls onto the sheet metal roll 2. The computer 15 is programmed to rotate the sheet metal

coil 2 so as to maintain a slack portion 2S of sheet metal between the sheet metal drive 11 and the sheet metal roll 2.

In this manner, the sheet metal drive 11 then does not have to rotate the sheet metal coil 2 but only moves the end portion 2E of sheet metal forwards and rearwards. The inertia of the sheet metal coil 2 can be quite substantial where the coil 2 is large, leading to slippage and jerky motion of the end portion 2E where the inertia must be overcome by the sheet metal drive. Provision of the slack portion 2S much reduces the forces that must be exerted by the sheet metal drive 11.

The apparatus 1 further comprises upper and lower straightening rollers 21, 6 which are operative to flatten the end portion 2E of sheet metal such that same lies flat on the sheet support under the first path X of the cutting head 8. The illustrated roller 6 is both a support roller and a straightening roller.

The apparatus 1 further comprises a guide bearing against the edges 22, 23 of the end portion 2E. A first guide

roller 24 is fixed and bears against a first edge 22 and a second guide roller 25 is biased against the opposite second edge 23 of the end portion 2E. The first and second guide rollers 24, 25 are located adjacent to the first path X. A third roller 26 is fixed and bearing against the first edge 22 at a location between the first guide roller 24 and the sheet metal coil 2. A fourth guide roller 27 is biased against the second edge 23 at a location between the second guide roller 25 and the coil 2. The biased rollers 25, 27 allow for variations in the width of the sheet metal.

The apparatus 1 can be operated to cut sheet metal pieces from a sheet metal coil 2 by positioning the end portion 2E from the sheet metal coil 2 to rest on the sheet support rollers 5, 6 and table 7. The cutting head 8 is moved back and forth above the end portion 2E along the first path X and the end portion 2E is moved forward and rearward along the second path Y. The movements of the cutting head 8 and the end portion 2E along the first and second paths X, Y are coordinated by the computer 15 such that the pieces are cut from the sheet metal. The computer also rotates the coil 2 so as to maintain a slack portion 2S of sheet

metal between the sheet metal drive 11 and the sheet metal coil 2.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous changes and modifications will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all such suitable changes or modifications in structure or operation which may be resorted to are intended to fall within the scope of the claimed invention.